

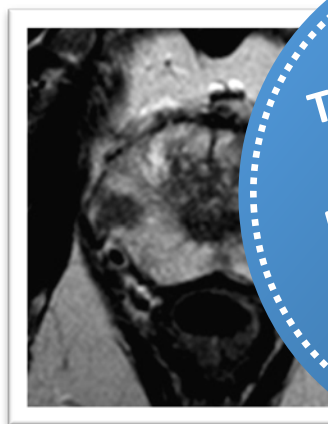
an educational pamphlet

6

Prostate Cancer MRI

Accurate Diagnosis and Treatment

Magnetic Resonance Imaging



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PSA to Prostate MRI

for patients and curious doctors

Samuel Aronson, M.D.

Vincent Pelsler, M.D.

Franck Bladou, M.D.

Armen Aprikian, M.D. & Marc Emberton, M.D. Forewords

Can you imagine treating a patient
for a high fever, racking cough, pneumonia
without a chest x-ray or CT Scan?

We can not imagine
diagnosing or treating prostate cancer
without being able to image it.

That's what we were doing.

The prostate today can be seen
in structural and functional detail with
multi parametric prostate MRI.

Prostate MRI

What Can It Really Do?

Accurately Identifies, Characterizes, Defines and Stages
Prostate Cancer Nodules

Identifies

- > Number of nodules
- > Nodule(s) location within the prostate
- > Nodule(s) volume
- > Capsule invasion

Characterizes

- > The likelihood of cancer
the **3** parameters (T2w, DWI/ADC, DCE)
- > Cancer aggressiveness (predicts Gleason grade)

Defines

- > The most aggressive significant (Index) Cancer Nodule

Stages (below the aorta bifurcation)

- > Cancer involving the capsule, adjacent, seminal vesicles, bones, nodes

Prostate MRI, 94 % accurate in finding significant prostate cancer nodules

How Does It Do It?

3 *parameters characterize prostate nodules
the likelihood of cancer
(predicts Gleason grade)*

T2w – anatomy (chief TZ cancer detective)

T2 weighted Images

DWI/ADC - biology (chief PZ cancer detective)

Diffusion **W**eighted Images

Apparent **D**iffusion **C**oefficient

(restriction of water diffusion among cancer cells)

DCE - vascularity

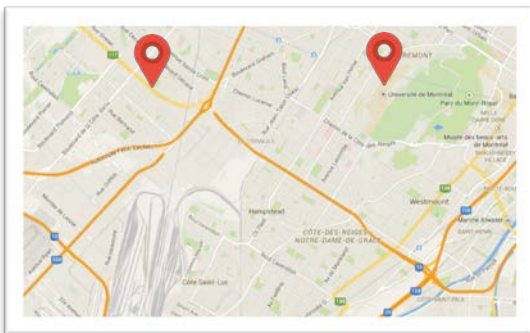
Dynamic **C**ontrast **E**nhancement

mini angiogram, gadolinium injection

T2w roadmap

DWI/ADC traffic congestion

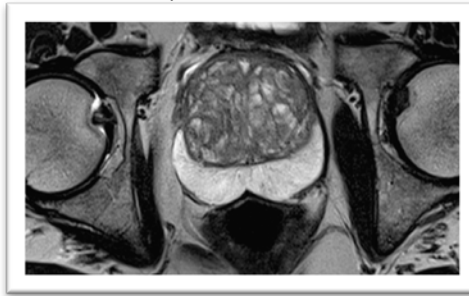
DCE new arterial construction



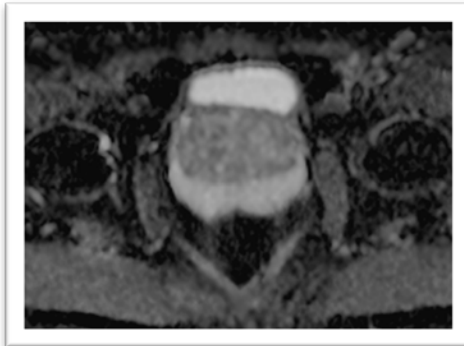
the **3** MRI parameters

Normals

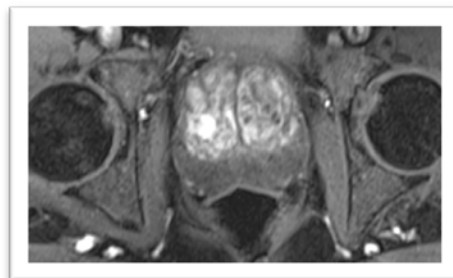
Courtesy of Dr. M. Emberton



T2w



ADC



DCE

*68 years, brother with prostate cancer,
PSA 4.2 → 5.9, over 5 years, PSAD 0.08
DRE- no nodule, no biopsy indicated*

The MRI Report

Patient – Age, prostate cancer Risk Assessment data
Initial MRI, Previous MRI
5 alfa-reductase inhibitors

Prostate volume, PSA, PSA Density

Identification

- > Nodule(s) **location** - 27 sectors / 39 sectors
- > Nodule **volume**

Characterization – **Likert/PI-RADS**

3 Parameters - T2w, DWI/ADC, DCE – **5 point Score**

- 1** Highly likely **No** cancer
- 2** Likely **No** cancer
- 3** Unsure
- 4** **Likely** cancer
- 5** **Highly likely** cancer

Tumor Staging - **capsule, cancer outside** the prostate
(adjacent, seminal vessels, bones, nodes)

Comparison to previous MRI

Other incidental findings
(bowel, bladder, large blood vessels, hernia, etc.)

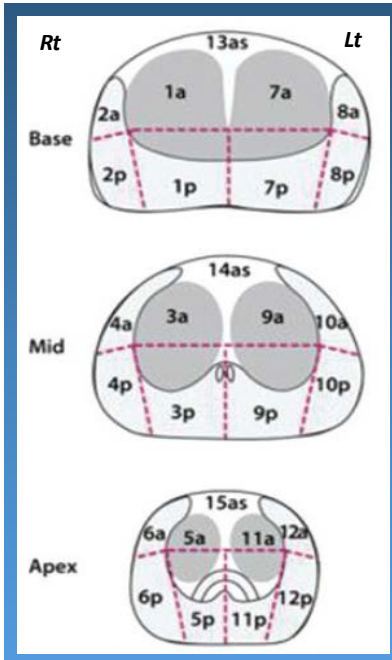
Radiologist Summary

- Initial MRI** – **Screening** - a baseline reference
- **Diagnostic** - specifies nodule(s) to biopsy, cancer staging
- Repeat MRI** – **Monitoring** - men at risk, active surveillance
- residual or recurrent cancer after treatment

Prostate Sectors

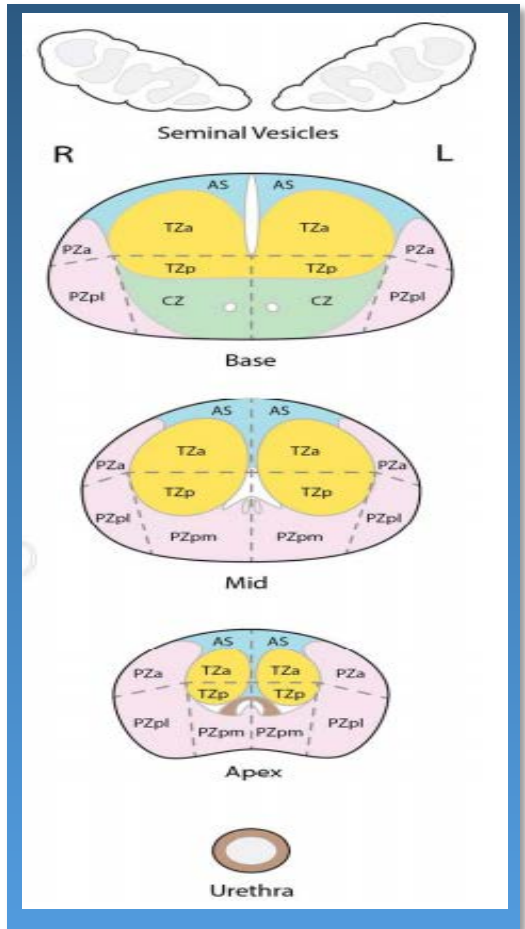
27 Sectors

Dickinson, L. et al. Euro Urology, 59
(2011) 474-494.



39 Sectors

PI-RADS v2
American College Radiology
pub. online 2015



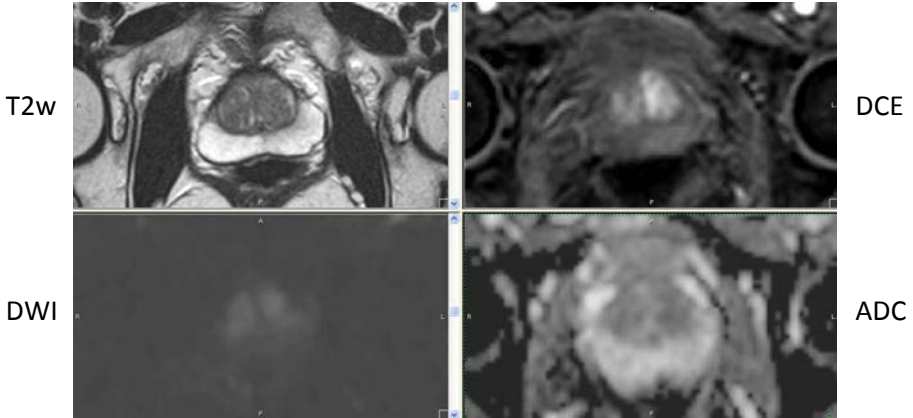
- AS anterior stroma
- TZ transition zone
- PZ peripheral zone
- CV central zone
- a anterior
- p posterior
- pl posterior lateral
- pm posterior medial

The **Significance** of a nodule imaged on MRI *depends on:*

- > **Individual Risk Assessment** (includes some of these criteria)
 - age, life expectancy, major illnesses, family-genetic history, Race, chemical-medication exposures, previous (UTI, MRI, biopsy, pelvic surgery, radiation), predictor tables, urology exam, DRE, urinalysis-culture, PSA, PSA trend, biomarkers, testosterone, renal function, TRUS-PSA Density
- > **Patient data** provided in the MRI requisition
- > **Quality** of the MRI image acquisition
 - Do MRIs before biopsy artefacts, makes interpretation more difficult
 - 5- α -reductase inhibitors change prostate MRI morphology decreasing cancer nodule volume and lowers PI-RADS scores
- > **Experience and quality** of the Radiologist, Urologist and Pathologist
- > **Nodule(s)** size, location, 3 Parameter Score **1,2,3,4,5**
- > **Index Cancer Nodule** (most aggressive)
 - largest volume, highest score or involving the capsule
- > **MRI Local Staging** (below aorta bifurcation)
 - 1 Cancer nodule
 - confined **inside** the prostate ≤ 0.2 cc
 - confined **inside** the prostate ≥ 0.5 cc
 - 2 Cancer nodule involves prostate capsule and/or neurovascular bundle
 - 3 Limited local cancer **spread** - adjacent, seminal vesicles
 - 4 Cancer **spread** involves bladder, rectum, nodes, bones
- > **Biopsy** Gleason grade

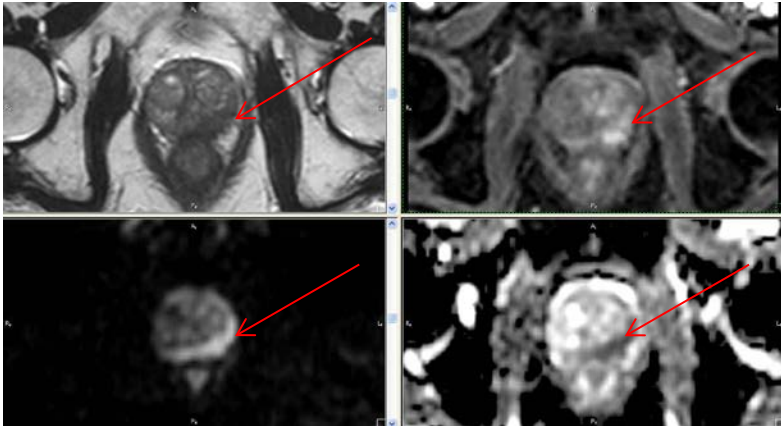
Black gentleman, PSA 4.1

- Age 57, life exp >10 yrs, Fhx brother Pca
- PSA (over 5 yrs) 2.1-4.1, DRE neg. MRI 45cc, Sc 1, PSAD 0.09
- No biopsy indicated



DRE +, PSA 5.8

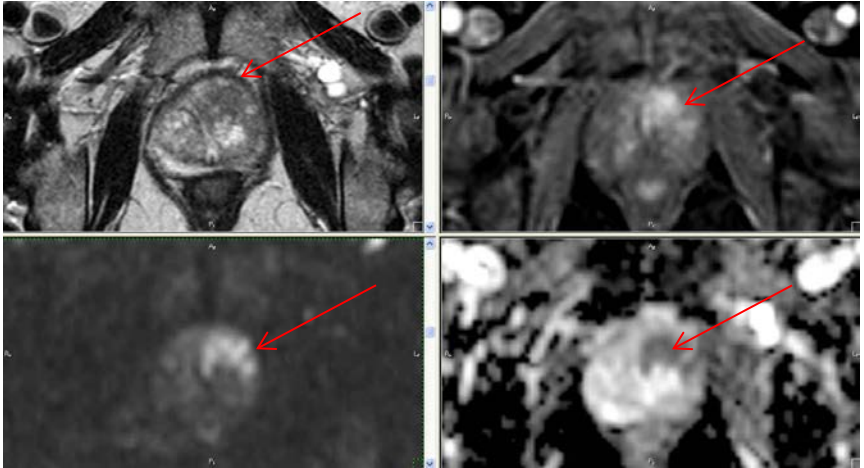
- Age 70 wm, life exp >10 yrs, no Fhx, PSA 2.3-5.8 (7 yrs)
- DRE +, MRI 49 cc, Sc 5, PSAD 0.11, nodule 2.6cc (Lt PZ, PL, 10p, 12p)
- Biopsy Gleason grade 4+3



Courtesy of Dr. V. Pelsser

3 previous biopsy sessions negative

- Age 67 wm, Fhx +, life exp > 10 yr, PSA 2.9 - 9.4 (10yr)
- DRE neg, MRI 52 cc, Sc 4-5, PSAD 0.18, nodule 1.8cc
Sector Lt AS, TZa, 14 as, 9 a
- Biopsy Gleason grade 4+4



Prostate Cancer Risk Assessment selects men for MRI MRI selects men for biopsy

TRUS/MRI Fusion Targeted Biopsy

- > Fewer biopsy sessions, fewer biopsy complications
- > Earlier diagnosis, earlier treatment
- > Less diagnosis of not-aggressive
insignificant low grade cancers
- > Less over treatment

Prostate MRI: A Team Effort

- Radiologists** Provide and interpret the MRI to identify the undiagnosed, residual or recurrent cancers.
- Urologist** Use the MRI to select which men to biopsy, where to biopsy, in treatment decisions and monitoring.
- Pathologists** Provide the tissue proof of the presence of cancer, the concordance with the MR images.

The JGH Team

- Radiology** – Drs. F. Discepola, M. Levental, A. Mandelanakis, V. Pelsser, L. Rosenbloom
- Urology** – Drs. M. Anidjar, S. Aronson, F. Bladou, A. Brzezinski, L. Campeau, S. Carrier, J. Corcos, S. Jacobson, O. Loutochin, nurses and staff
- Pathology** – Drs. A. Gologan, M. Alameldin

Prostate MRI requires precise image acquisition, experienced **radiologist**, MRI knowledgeable **urologist** and **pathologist** to prove the presence of cancer

Prostate MRI

Imaged Based Prostate Cancer Management

For Diagnosis

- > Which men to **biopsy**
- > Which sector to **target** the biopsy
- > **Monitor** patients not requiring biopsy

When Cancer

- > **For** Treatment – helps selects type and planning
- > **After** Treatment – evaluation for residual or recurrent cancer

Treatment Options

- > **Pre Programmed Follow-Up** – MRI monitoring men at risk, no cancer diagnosed
- > **Active Surveillance** – MRI selection and monitoring diagnosed not-aggressive, insignificant untreated cancers
- > **Surgery, Radiation, Focal Therapy, Medical Oncology** and combinations

References

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SAMUEL ARONSON, M.D.

Assistant Professor of Urology, McGill University

Jewish General Hospital
3755, Côte Ste-Catherine Rd, E-959
Montreal (Quebec) H3T 1E2
Phone: 514 340-7558
Fax: 514 340-7559

Physimed Health Group
6363, Transcanada, suite 121
Montreal (Quebec) H4T 1Z9
Phone: 514 747-8888
Fax: 514 747-0655

VINCENT PELSSER, M.D.

Assistant Professor of Radiology, McGill University

Jewish General Hospital
3755, Côte Ste-Catherine Rd, E-959
Montreal (Quebec) H3T 1E2
Phone: 514 340-7558
Fax: 514 340-7559

Design by Annie Desjardins

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www.pcamri.com

info@pcamri.com